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Schedule and Cost

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Schedule

The ultimate goal is to have a functional autonomous shuttle system open to riders by mid to late fall, 2018. The schedule as outlined below summarizes the major milestones and their optimal timeline for completion:

- **Vendor engagement**
Begin in early 2018
- **Waiver from Federal Motor Vehicle Safety Standards**
from NHTSA
February, 2018
- **Exemption from Nebraska regulations and creation of AV Proving Ground**
March, 2018
- **Vehicle vendor(s) selected and vehicle's procured**
Summer, 2018
- **Pilot Testing**
Late Summer / Fall, 2018
- **Full Operations**
Mid-Late Fall, 2018

Business Models Overview

There are several potential business models that could be used to fund the pilot project including a fully City funded pilot, a pilot funded by obtaining research grant funding, or funding the pilot through a public-private partnership(s). Funding options could also be used in combination as well.

City Funded

Given the relatively new nature of the technology and the objectives of the pilot project, it may be challenging for the pilot to be fully funded through fare revenue collection and/or commercialization of advertising space on the vehicles and/or stops given the short duration of the project and the unknown ridership and market penetration. One important component of the pilot will be to test how a larger deployment of shuttles could be partially supported with a reliable revenue stream. A fare-supported model would charge users of the shuttle service on either a per-month or a per-ride basis, giving passengers the flexibility adapt their payment option to their use of the shuttle. Frequent users of the service might opt for a monthly fee, while infrequent users would be better suited for a per-ride fee. The City will need to balance the fee to be low enough to attract users, but high enough to generate revenue to offset some cost of operation. A business model that partners with other organizations or businesses could offer additional ways to generate steady revenue. Heavy users may want a dedicated stop along the route to give better access to off-site parking, or connect to high concentrations of parking and amenities. Additionally, revenue can be generated by selling the exterior of the vehicles with “wraps”, in a similar fashion to what is typically done for buses.



Figure 6.1 Bus wrap example

Image source: Sounder Bruce <https://flic.kr/p/sc3NLD>

Research Grants

As an alternative to the city self-funding the pilot, there are a number of research and other grant opportunities that may provide funding. Funding transit technology such as autonomous vehicles is generally an allowable component to many Federal transportation funding grants.

Partnering Opportunities

Finally, there is the potential for the City to partner with other public-private entities to establish a microtransit autonomous vehicle proving ground in Lincoln that could attract private investment. For example, in 2017 the U.S. DOT designated 10 Autonomous Vehicle Proving Grounds across the country as locations where testing and research by both public and private entities could be performed. Several of these proving grounds have kick-started their activities through the use of a public-private partnership. For example, as part of the Texas Alliance, the City of Arlington, Texas is establishing a microtransit service within the city limits through a partnership with Chariot, a private transportation provider. The City of Lincoln could engage various industries to utilize the vehicles as a proving ground to test, in a real-world environment, emerging technologies such as those associated with electric battery utilization and charging, emergence of 5th Generation (5G) cellular technology, and new advances in pedestrian and vehicle safety systems.

Cost

Three primary options are available for the acquisition of autonomous microshuttles, and include outright purchase, contract with a service provider, or a lease. These options are briefly described, along with the estimated cost of each option, not including roadside infrastructure.

Purchase vehicle directly

The option that offers the most control for the City is to purchase the vehicles outright. Vendors have provided estimates on the cost of an individual vehicle at approximately \$350,000 and a yearly operating cost of approximately \$47,000 per year. The operating cost covers the supervision, fleet management, system licensing, and ongoing maintenance. Insurance would not be part of the cost.

Contract with a service provider

A number of microshuttle deployments within the United States and Europe have been managed by transit management / fleet management companies. This option offers the most turn-key solution to the City, who would contract directly with the management company to manage all aspects of the pilot deployment. Companies such as FirstGroup, TransDev, and Keolis have all managed deployments of both EasyMile and Navya shuttles. These companies would own the vehicles, provide maintenance, insurance, and operations of the pilot, in addition to any employees needed.

Preliminary quotes of the service provider option are estimated around \$725,000 per year for a four-vehicle deployment, and one full-time employee. This option assumes that “shuttle ambassadors” are provided by the City or one of its partners. This option would cover the cost of maintenance, insurance, overall management of the fleet, and coordination of any transit deployment apps that would be needed.

Lease through lease agreement

Vehicle vendors are in the process of solidifying options for turn-key lease agreements that would cover the cost of the microshuttle, maintenance, insurance, and the cost of the “back end” operations. This option would not include any employees, and the City would be responsible for

coordination of any apps and transit payment modules. This option offers a good amount of flexibility and an upfront cost that is likely lower than the other two options, but does leave some effort for the City in terms of staffing and management.

Cost Estimate

The most appropriate option for Lincoln will ultimately depend on the duration of the pilot, how much effort the City is willing to cover in-house, and how the technology progresses. As the technology becomes more widespread, and as more companies enter the market, there may be fluctuation in prices that make owning vehicles a less desirable option.

For the purpose of this project and this cost estimate, the lease option has been used as the basis for vehicle cost. Based on preliminary discussions with vendors, an estimate of \$140,000 per vehicle per year has been used as the assumed lease price. This yearly price includes the cost of liability and collision insurance for the vehicle.

The estimated costs associated with a 2-year deployment of autonomous microshuttles in Lincoln are shown in Table 6.1. This preliminary cost estimate includes the infrastructure components such as DSRC radios, GPS repeaters, signing, pavement marking, charging facility upgrades, and installation of equipment. In addition, ongoing costs associated with the lease and insurance of four vehicles as well as annual maintenance of vehicles and equipment were estimated.

Total preliminary cost is estimated at approximately 1.39 million dollars, although a conservative approach may be appropriate for budgeting purposes, with an upper range of approximately 2 million dollars.

As the project moves forward and more details regarding the vehicle requirements and specific transit stop locations are determined, this cost estimate must be updated to reflect the most current quantity and unit cost approximations.

Table 6.1 Preliminary cost estimate - Lease Agreement

Item	UOM	Unit Cost (\$)	Quantity	Total Cost (\$)
Initial costs				161,385
DSRC radio	Each	1,400	19	26,600
DSRC radio installation and labor	Each	5,000	19	95,000
GPS repeater	Each	300	10	3,000
GPS repeater installation and labor	Each	2,000	10	20,000
Signs (stop signs, transit signs, parking signs, reference markers)	SF	20	490	9,800
Installation of signs	SF	6.50	490	3,185
Pavement markings	LF	0.50	2600	1,300
Upgraded electric for charging facility	LS	2,500	1	2,500
Ongoing costs (2 years)				1,225,500
Vehicle lease, maintenance, and support from vendor	Each / year	140,000	8	1,120,000
DSRC radio annual maintenance	Each / year	2,250	38	85,500
GPS repeater annual maintenance	Each / year	1,000	20	20,000
Total preliminary cost estimate				1,386,885